SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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Royal School of Mines.

Mr. WARINGTON SMYTH'S LECTURES ON MINING.

Lecture XXXIX.—He had already mentioned some of the reasons why it was important to lay out a general plan of the workings beforehand, as far as was consistent with that uncertainty which necessarily surrounded all mining; but when they came to make a choice of systems, between pillar and stall and long wall workings, for instance, they would find that those modes were as opposite to each other as possible. He had shown how very great a loss of property to the country at large, as well as to the individual owners, occurred from the selection of merely wrong dimensions in opening pillar work, and how, besides the men being exposed to considerable risk, there was a constantly increasing expense to the owners by beginning with openings too large at first; and the same remarks applied more or less to the systems he was now about to consider, which formed an intermediate link between the pillar and stall and the long wall systems. The old plan was to work out a district or division of the mine, and then remove what was left in that division, beginning at one end, and leaving the debris to form a goaf. The structure and form of this goaf were important, as affecting the safety of the men and of the other parts of the mine, and many differences in these respects would arise, chiefly depending upon the nature of the material allowed to fall and make the goaf. Supposing they were dealing with a 5-ft. seam, then 5 ft. of shale, and then beyond that some variety of lime or sandstone; the shale would form an excellent roof while the work was going on, but, nevertheless, when they came to remove the pillars it would not long stand under the weight of the superincumbent masses. It would begin to scale off, and when the unsupported area became large would come down altogether, and if there were many fissures in it probably close upon the men. Sometimes large areas of roof came down with a most tremendous pressure, so that a roof of stone over coal breaking away in these large pieces left great interstices, which formed dangerous reservoirs for the explosive gases. Beginning, then, at one end of a district, there will be a long line of boundary, which must be watched as closely as an enemy's fortress. Where the gases escape and meet with the body of air produced by ventilation they are swept rapidly away; but if there are goafs scattered about here and there the workings will be most dangerous, and in this respect the long wall system has a great advantage, inasmuch as the worked portion of the ground is totally done with and left behind. A system approximating to pillar working is much practised in South Wales, as at the Risca Colliery, where, in order to divide the coal into convenient districts, cross headings are driven out, and then from those cross headings stalls are opened. This system (illustrated by a plan) was a very wasteful one, and there had been a great number of accidents, which were due to irregularities which characterised the workings. Other varieties of considerable interest were to be met with in North Wales, and in parts of Yorkshire. In working the Barnsley thick coal, 8 or 9 ft. in thickness, a method was adopted which was not exactly pillar working, but which, nevertheless, in its earlier stages was extremely like it. From the level at the pit bottom parallel bord gates were driven upon the rise of the seam, and roadways into the coal at about 90 yards asunder. The workings being advanced up to a certain point in this step fashion, and divided one from another by narrow ribs, a sort of pillar is left, rather thicker, joining the upper level from which they start, which is something between pillar and long wall working. The ribs are afterwards cut through to allow air to pass, and so when these rib pillars are greatly weakened the roof comes down. A great disadvantage in this plan is that the gas, from its specific lightness, constantly makes its way to the part of these upper workings where the men are employed, and the unventilated goafs in every direction are magazines of the most dangerous character. The workings at the Lund Hill Colliery (of which a large diagram was exhibited) furnished another modification of the pillar system. With all that might be said for the convenience of some of these modes under certain aspects, and the fact that a large proportion of coal was taken out, it could not be denied that some of the most frightful accidents the colliers ever experienced had occurred in them. These were doubtless the result of the impossibility of ventilating the old wastes, every one of which became a depositary of explosive gases. These workings might be modified without a great change of plan, and turned into a condition nearer that of the long wall system. There was always a difficulty in getting rid of systems long in use, but that ought not to prevent a change for the better. And even in respect to the quantity won, although the pillars were brought away in good condition, and of large size, the percentage obtained was smaller than in other systems, because they were obliged to leave the ribs. After referring to a number of minor modifications of the pillar and stall system, Mr. Smyth remarked that, with all that might be said for this method, such as its convenience, the facility with which they could extract a large amount of coal, there was no denying the fact that some of the most frightful accidents in Europe had occurred in mines where it had been pursued, and it was undoubtedly open to the objection that it led to the formation in the midst of the workings of a series of dangerous reservoirs of gas, every one of which might be looked upon as a gasholder, giving off every time the barometer fell a larger amount of gas than usual, and if the men were working with naked lights on the rise side of one of these goafs they were in constant danger from the firing of the gas. Even supposing they were working with lamps, and under comparative conditions of safety, they were still subjected to the risk of accidents incidental to the working of even the best conducted collieries. To lessen the risk attending this system it had been usual in some collieries to allow a current of air to pass through the goafs, but this was a very unsatisfactory plan, as it did not thoroughly ventilate them, and in some cases it had been said to be even worse than if no attempt had been made to carry air through them—such as where fire-damp was given off, in which case the introduction of a little fresh air would just suffice to render it explosive, bnt not to make it harmless. Now, it was very important to know that those workings might be considerably modified without a very great change in their plans, so as to be thrown iton a form much similar to the regular long wall workings, and this had been done by the managers of some of the South Yorkshire collieries, apparently with very considerable effect. Wherever a certain mode of working had been long in use, a great prejudice existed in favour of it; but he believed that if properly examined into many of the advantages of these modifications would disappear, and in many respects on comparison the long wall plan of working would be found to have the advantage. The principle of this mode was the removal of the whole of the mineral, without leaving temporary pillars, and it was naturally first introduced into districts where circumstances favoured its adoption, as, for instance, in the coal measure districts in which ironstones were largely prevalent, and where a large quantity of refuse had to be left behind, so that the modes by which ironstone were worked underground partook more or less of the long wall system. It was specially desirable, then, to introduce that system wherever there was a large quantity of refuse. With regard to the thickness of the seam or bed which rendered this method advantageous, it was not easy to fix a definite limit. Although there was a prejudice in favour of its being specially applicable to very thin seams, such as from 2 to 3 or 4 ft. thick, it was also found, in districts where the men were thoroughly accustomed to it that it might be advantageously applied to the working of seams 6 or 8 ft., and even as much as 9, 10, and 11 ft. thick; and, in fact, as he would show them in speaking of unusually thick seams, it had been adopted advantageously in the thickest seams known. The long wall system assumed a great many different shapes, which are in different districts more or less dependent on actual necessity, and left very much to—he would not say chance, but to fancy, or the custom of the district, or the ideas of the directing manager. Thus, for example, it is common in Shropshire, where the long wall system is much patronised, to branch out a number of roadways from the pit bottom to the extremeties, and then working back nothing is left behind but goaf or gob. In other places they commence at once near the shaft to work away the mineral, maintaining means of access to fresh faces by roads artificially supported through the waste. Sometimes those faces were not straight, but followed the lines of cleat; and in others, where the coal is tender, and the pit deep, it was found that more coal was obtained by working on the end. Sometimes a great length, perhaps as much as from 100 to 400 yards, may be opened in a single line, and at others 30, 40, or 50 yards of straight face are thought enough to form a stall, each following the other closely up. Let us now turn our attention to the face or front of the working, which, as it is but a few feet or yards away from the waste where the roof has "come down," requires to be carefully protected; the usual way is to plant a double row of props, sometimes three rows are needed, arranged alternately, and at right angles to the roof and floor. Each prop takes a good bearing on the roof, by carrying a piece of wood, the "lid" or "tymp," 12 or 15 inches long, which first receives the pressure, and is soon squeezed or broken. Cast-iron has been occasionally employed for the purpose, but the props are usually of larch, or in low seams of oak; and whilst with unsound roofs they have to be set thickly, in the common way they may be many feet apart. Where the heaviest roof pressure is expected "nogs" or "chocks" are employed, instead of single props; these are pieces 2½ to 3 ft. long, built up two and two crossways, thus giving a broad base and summit, and the advantage of being easily knocked asunder for removal. Suppose the coal now holed to a sufficient depth all along the face, the pressure of the overlying mass will tend to force it down, and in some places actually saves the collier the labour of felling, the coal by itself performing that office in the course of a few hours. Otherwise, by wedging, or blasting, the coal is brought down, then broken up and removed. And now, all slack, unsaleable coal, and rubbish being thrown behind the men into the gob, or waste, the back row of props is pulled out, and they are set up again in front of the fresh face of coal, while the whole operation starts for the succeeding day *de novo*. Meanwhile, the removal of the coal towards the shaft is a care of the first magnitude. If the roof be excellent, the coal strong, and the out-put important, iron rails (to be moved from day to day) may be laid along the face, on which the trams, or tubs, will be chiefly conveyed. But when, as most frequently happens, this advantage cannot be had, the coal has to be dragged or putted in sledges along the uneven floor in front of the face to the nearest outlet, and it hence becomes necessary to have roads opening on the face at frequent intervals. If we are working back from the extremities, no more need be said than that the roads as the work advances are constantly being shortened, and that the expense of their maintenance is thus diminishing; but if we follow the usual method, the "gob roads," as they are called, are daily increased in length, and the charges of keeping them in order become a very heavy item of expenditure.

Lecture XL.—A mere glance at a figure representing the long wall working would show that in workings of a moderate extent it introduces an obvious advantage, in its greater simplicity as regards the face of the actual workings, and therefore in the ventilation of the mine. In driving the levels, then, regard must be had to this point, and they must be arranged so as to allow a strong stream of air to pass. The great difficulty, however, is in deciding whether it is wisest to establish a number of different wastes in which the roof has fallen, in which case separate arrangements will have to be made for the security of each set of men, or whether one course of air should be carried through the whole. In the latter case there is the objection that one place which is explosive may be brought into communication with another that is not explosive, a risk which attends all workings which are brought to one base, and where the ground does not close up to such an extent as not to allow of the collection of fire-damp in hollow places. Looking closely into all the circumstances, there is no doubt the long wall system combines great advantages, both in the removal of the coal and the absence of danger; and it is, therefore, surprising that in some districts the colliers should have such a strong prejudice against it. It is worked principally in Shropshire, Derbyshire, Leicestershire, Somersetshire, the Forest of Dean, in some parts of South Wales, and in Scotland; and abroad, chiefly in Belgium and Saxony, and in a few Westphalian mines. In these places coal is met with of every sort, and seams of all kinds; and the proportions and conditions of long wall working in them vary as much, or more, than the arrangements of pillar working. Where the seams are inclined at a considerable angle, the workings then approximate nearly in several points to the working of a lode, as in the example of the Berthelsdorf coal field, in Saxony, where the seam is at an angle of 80°, or nearly vertical, and is worked by stopes. In Belgium they have some remarkable seams, which lie at different angles in alternate districts, the one almost horizontal, and the next separated by faults, elevated at a great angle, the mode of working which is nearly the same as the long wall working in Saxony in its general aspects. The lecturer then at great length, by means of drawings and diagrams, portrayed the common mode of working in Belgium, by what is there called a *soutment*, a word implying a district to be worked out at once, but a technicality not to be found in the dictionaries. In Derbyshire a good solid rib of coal was left on each side of the level. At Radstock, where there are several seams of small thickness, one of 13 in., and another of 11 in., neither of which would pay by itself, and where a seam of 2 ft. 2 in. or 2 ft. 4 in. was looked upon as unusually thick, a viewer from the North of England suggested as an improvement the Derbyshire plan of leaving a good solid piece on each side of the roadway, to give it strength. The depth being 156 fms., and the seam only 26 in., he proposed by this means to leave a pillar of 20 yards broad. But even with that great breadth the creep was found to fill up the road, and therefore, that it was better to go back to the old system, by which the roof, being secured by pack walls, stood while the whole of the coal was removed. In Wales, and in the Forest of Dean, they avoided much of the expense of maintaining roadways by starting with wide work at once, and without driving out preliminary levels. Of course, they leave a good shaft pillar, and then drive out a large space, sufficiently wide to be like a regular long wall face of work. The goaf follows up very closely, and to keep up the communication they pack a road all the way along on both sides with attle, with the addition of timber when necessary. This was a good and economic plan when the conditions were favourable; they had from the first a fine face of work, and the only question was how near to each other the gob roads should be carried. These roadways ought to have the ends near each other, to prevent the difficulty of carrying the coal by the face, and they should generally speaking run within 20 or 30 yards of one another. In other places, of which Lund Hill was an example, the nature of the coal and of the roof has led to a sort of combination between the long wall and the pillar and stall systems. He recollected being down the unfortunate Oaks Colliery some years ago, where the old method of working had been successfully replaced by a modification of the long wall system, and they had then a magnificent draught of air at the face of the workings, in those places where the coal was known to be dangerous. In Leicestershire and Shropshire, where the coal has much regularity of structure and position, they are able to work with a face in a long continuous line, without breaking it into separate stalls; but the ironstone in the latter county, which has neither a regular structure, nor lies in one direction, is worked out from the foot of the shaft, in a circular form. In certain districts there is much irregularity of form, and they would find by a reference to the interesting reports of the Inspectors of Mines for Scotland, that that was very much the case there. One particular modification of the long wall system required especial mention, that of the fine colliery at Moira, in Gloucestershire, where, whenever the air gained access to the small coal or slack, it was apt to occasion spontaneous combustion, than which nothing could be more dangerous, as they were constantly exposed to the chance of the coal taking fire, while the same conditions as produced the tendency to take fire produced carbonic acid, so that it was very necessary to take especial precautions. It was, therefore, usual at Moira, where the long wall system was admirably carried out, to construct what is called a "wax wall" along the pack wall—that was, to build up an interior wall of well-tempered clay, so that the air cannot get to the slack. This also keeps the fresh air from getting access to the gobbing, and was most effectual in preventing mischief where the slack has this unfortunate quality. In other districts, as Somersetshire and South Wales, various modifications resulting from geological peculiarities were not uncommon. The introduction of the long wall system into the North of England, where it had not been used before, had had very satisfactory results. The men were much in favour of the pillar system; but in several deep collieries, such as those of Monkwearmouth and Hetton, the long wall system had been found very useful in working out the pillars which had been there laid out in large dimensions, (say) 30 yards by 60 yards, and thus the whole was obtained, and mostly in the state of round coal. In large workings, where there was a great overhead pressure, it was a serious question whether this combination of systems was not the most advisable; and there were instances in North Staffordshire where it had been proved to be satisfactory. (The lecturer then, by means of the board, showed a number of combinations, based on actual examples.)

Lecture XLI.—There yet remained to be noticed the methods in vogue where the seams are of such unusual thickness as to render it impossible, with safety to the men and advantage to the colliery, to adopt the more ordinary style of operations. The task of dealing with beds of great thickness was always a matter of difficulty. They could not open these large spaces at once without special precautions to avert fractures of the roof. This difficulty existed in a remarkable degree in the coal fields in the centre of France, where unusual thickness is coupled with great irregularity. The French Government, looking at the great loss of life which took place in these coal seams, long ago appointed a commission to enquire into the best methods of working thick seams. These seams in France are of such curious forms as to indicate unusually violent disturbing action. They run occasionally to the great thickness of 70 ft., 80 ft., 150 ft., and in one case 250 ft. (near Firming). Last spring he (Mr. Smyth) visited the coal fields in the south-eastern districts of France, more particularly those of Creuzot and Blanzy. At the former place the seam is from 190 ft. to 200 ft. in thickness. All the seams are tilted up at a great angle, and are variously interfered with and much broken in places, which renders the working a matter of considerable difficulty and uncertainty. It was at this place, as mentioned in a former lecture, where a bore-hole was put down to the enormous depth of more than 3000 ft. for exploring purposes, which has not been successful in reaching either of these seams as yet. It was found impossible to work the seams by any method he (Mr. Smyth) had hitherto brought before the students, and the Government commission reported strongly in favour of a method of working in which a limited space would be opened out at one time, and then packed or filled in with "remblais," or rubbish brought down from the top. The shaft is then sunk on the rise side of the seam if it be nearly vertical, and a level is driven until it intersects the opposite side of the seam, and then they drive up along the seam as wide an opening as is consistent with the safety of the roof over the men's heads, and with a height of 10 or 11 ft., or according to the thickness of the deposit. Parallel levels are driven in the same manner, making a sort of pillar working, with the roof in the solid coal. Between these levels cross openings are made, partly for ventilation and partly to get out the coal, leaving by these means large square pillars. Having worked one level in this manner, a commencement will be made of working the next upper level in the same way, making the pillars as nearly as possible over the pillars in the workings below, and in some places assisting themselves with packing, and especially during the last process, that of removing as much as possible of the pillars. At the commencement of this century a practice arose of leaving the pillars which are to be got out at last, of very large dimensions, so that what is left may be of good quality when it is removed. Working in thick deposits is comparatively easy when there is a large quantity of refuse compared with the mineral to be won, and there are ironstone workings in this respect in the Derbyshire measures which are somewhat peculiar. Many of these important bands in Derbyshire have been worked for 50 or 60 years. The black shale ironstone, for instance, furnishes one of the best examples of the mode of extracting the ironstone from out of a considerable thickness of measures which is carried out largely in that county. These ironstones are extremely fine in quality, and in other respects they are very interesting, as they contain various species of metallic sulphides crystallised in their hollows. The pits are placed at distances of about 40 yards, and they are made to communicate with each other by drifts, for the purposes of ventilation and drainage. After these preliminary works are completed they begin to extract the ironstone by opening holes from the levels, or forming chambers, the dimensions of which are about 8 yards by 7 yards, from which the stone is removed; these are placed 3 or 4 ft. apart, leaving, therefore, narrow pillars between. The first cut will produce shale with the ironstone, and it may be necessary to send up some of the shale, but very soon the shale may be thrown under foot in the hole. Any weak place in the roof is kept up by punch props, and the ironstone is taken away as the men rise upwards. By this means the greater part of the iron ore is removed, and the roof or upper stratum breaks close, and forms a sort of goaf, but the fracture will not be very considerable; indeed, it will subside so thoroughly that after from twelve to eighteen months the pits may be put down to the lower measures, and the work commenced there in a similar manner. Care is again taken not to open too large a space at once, and without any risk and without losing any large proportion of the ironstone the band is thoroughly worked through. One of the most remarkable workings in the eastern French coal deposits is that of Blanzy, where there is very little refuse, and where the two seams are each of them from 40 to 60 feet thick in places. He (Mr. Smyth) had to acknowledge the great courtesy of the French engineers at these mines, who, without introduction, allowed him to obtain every information, and to inspect the workings, which are of the most interesting character. The main seam used to be worked in two successive lifts or stages. When the upper coal was got the roof was allowed to fracture and subside. They then commenced to remove the lower part of the seam, and, of course, had to deal with the difficulty occasioned by the broken ground above; but they managed, by aid of timber and packing to do so with more facility than would be expected. The drifts were opened out at first, and carried only about half the height of the portions of the seam to be worked. They now, to avoid the great loss of life which formerly attended these workings, employ the system of introducing "remblais" or filling, lowered from the surface. The system is to work in divisions or stages of four metres each, carried in ranges of openings of two metres in height, and drawn horizontally right across the seam of coal, which is inclined at a steep angle. The coal is cut out into pillars 10 in. square. The colliers work from 4 to 12 A.M., and then come in the *remblayeurs*, whose regular occupation is to take material quarried at the surface and sent down the shaft, run the trucks containing it into the workings, and commence to fill in the spaces from which the coal has been hewn. He (Mr. Smyth) satisfied himself that this packing afterwards made a roof for the next lower stage of working as safe or safer than the original coal roof was. By this system the coal is got tolerably large, and this is of much moment, since in the French mines much less round coal is obtained in proportion to the small than in England. He must say that at first he had doubts whether there could really be such a thickness of good solid coal all through, but although there is a parting in the middle the seam is continued with great regularity, and has all the same characteristics as our English coal, although of this extraordinary thickness of 40 to 65 ft. It is yet doubtful as to what depth it descends thus regularly, but there is enough to make this district one of great importance. In this kind of seam, as in other cases, the work divides itself into two parts—opening the ground, and removing the pillars. The latter being the most dangerous, the men employed in it are better paid. They, moreover, get a much larger quantity of coal (a good hewer will get above 8 tons), as it has been loosened by what has been done before, and they can get more down in a day's work than when opening the seam. This is a sort of problem which in some districts is important. In the department of the Isére, where there are thick beds of anthracite, the system is to cut across the seam and lay it open, by a sort of pillar working, first in stages, and then packing it by "remblais." Some of the most remarkable coal workings in France are those of St. Etienne, on the Loire, near the city of Lyons, from which is produced the largest amount of coal in the country, and which contributes greatly to the prosperity of the great manufacturing establishments of that district. In this field there are several seams, tilted at such different angles, and of such variable thickness, that very different systems of working have to be employed. In some he found the "remblais" system of filling up largely employed, even where they had to take the greater portion of the filling down from the surface. At Montrambert, where the beds dip at an angle of 60°, the system employed is very like our English stall working, assisted by timber, but trusting to packing to prevent the roof breaking down. The great Dudley seam, in Staffordshire, called the "Ten-Yard Coal," because the average thickness of the greater part of that splendid seam is at least ten yards, which supports to a great extent the manufactures of Birmingham, is so enormously productive within a limited area that it is in that respect the most remarkable seam in Europe. It is not so thick as some of the seams in France, but it lies at an easier angle, and at a moderate depth over a large district. The way it has been worked, however, is not satisfactory. It contains above 30,000 tons to the acre, but it is very well known that under the present system not half that quantity is got out, and often not more than 11,000 or 12,000 tons at the first or chief working. The pits are sunk to the bottom of the seam, and a "gate road" is drifted out. From this narrow cuttings, called bolt holes, are made at proper intervals, and then, leaving a sufficient thickness on the side of the gate road to keep it secure, the coal is wrought out from a "side of work," leaving large pillars 8 or 10 yards square. Each of these working places are probably 50 or 60 yards long and 30 yards wide, and, except the bolt hole, are separated from all the other workings by a thick rib of coal. Serious loss of life has resulted from the great height of the workings, but as this coal is nearly exhausted over a large part of the area it will in a few years become a matter of history that its working was exceedingly dangerous and unsatisfactory, and that from one of the finest seams in the world there was not only an inadequate proportion of coal won, but that it was got at an enormous sacrifice of life from falls more than from any other cause. Whenever, therefore, similar conditions occur a better system ought to be employed. The reason assigned for it being persevered with is its comparative cheapness, but when they remembered what a loss of life and of coal has been the result, it is pleasant to find in other places that a modification of the long wall system has been adopted. It was proposed long ago to work it on the long wall system, with a succession of stopes. This looks well on the face of it, as it would seem to secure all the coal, but it has never been tried. An ironmaster of good repute, Mr. Benjamin Gibbons, of

Shut End, near Dudley, as well as the eminent Messrs. Foster, adopted a plan for working this seam, where it is 26 to 30 ft. in thickness, in two divisions. The result was that it succeeded perfectly well, for the upper portion of the roof was allowed all the while to subside, following up the men, who worked protected by pack walls and props; and then, after a lapse of twelve or eighteen months, the same process was recommenced, and nearly the whole of the coal was thus removed, and the loss of life was very small indeed. From these and other experiments resulted the old square pillar and stall system, which, compared with some other workings, gives a larger proportion of the coal, and with very greatly increased security to the lives of the men employed.

LECTURE XLII.—Supposing, then, one of the various plans of working described were selected, the next question was the method of arranging for the conveyance of the mineral from the face of the workings to the bottom of the shaft, or towards the daylight, in the case of horizontal drifts. In the earliest times this was accomplished almost exclusively by hand. The mineral was taken up, and handed from one person to another (like the engine-buckets at a fire), and passed very often for considerable distances in almost total darkness. Previous to the year 1843, when the present Lord Shaftesbury introduced into Parliament an Act to prevent it, a considerable proportion of the coal in the Scotch collieries was conveyed underground in a similar way by women; and they often had to convey considerable burdens of coal in baskets for long distances, through passages in which the air was exceedingly foul. Even at the present day this system is almost universal in South America, where Indians are employed, and they carry on their backs burdens which seemed almost incredible, not only through the drifts and roadways, but even up the shafts. There is at this moment a mass of silver ore in the Museum of this institution, weighing upwards of 300 lbs., which had been carried from its bed in the vein along the roadways underground, and up the shaft from a depth of 45 fathoms. In this country we have but little work of this kind, but in the Forest of Dean the iron ore is carried upon wooden trays, with iron rims attached to them, from the face of the working by boys into the main roads. The reason why this system is at present adhered to in these mines was the extreme irregularity of the deposits of ore, which branched off in all possible directions, sometimes as a mere thread, and at others in considerable quantities, and in the most curious cavities. The yield too was, on the whole, so uncertain that it was impossible to work these devious veins on any definite plan; and, therefore, nothing could be done of a more mechanical kind. It was not uncommon to meet a line of from 20 to 30 of these boys, candle in hand, and with their loads on their backs, running merrily along, and vieing with each other in activity and zeal. The next step after this was one followed on a considerable scale in some pits—namely, that of dragging the material along the floor of the mine on a sledge or "slid," under circumstances where the workings were more regular, but where the wagons could not be brought up to the face. Next came "putting," by which the material was conveyed in some sort or other of carriage upon wheels, or by the common wheelbarrow, which latter, however, were more used in metalliferous mines than collieries. On that he had to remark that too little attention was paid to the barrow-roads, and, consequently, the labour of the men was greatly increased, and their efficiency lessened. The German miners had early paid attention to this, for in the writings of Agricola, to which he had so frequently referred, their wooden rails and four-wheeled wagons were described. It was difficult to trace the course of improvement in the English mines; but its progress had been very slow, for it was not until the end of the last century that Mr. Kerr, of Sheffield, an eminent coal-miner, suggested the use of cast-iron tramways with flange attached to the wheels, but now rolled or wrought-iron rails were general. The "rolley" or "trolley" was a kind of stage on wheels, on which the corves were placed, but now they were superseded by the use of trams, which could be taken up to the face of the work. These are of rectangular shape, but with sloping sides, so that the upper rim projected over the wheels. Having described at length various contrivances for placing the wheels so as not to raise the wagons too high, and thus render them both liable to tilt over, so as to secure the largest periphery, and, therefore, the least friction, without interfering with the height and width of the roadways, he mentioned that no rule could be given, and that tubs or corves of large size were to be found in different mines. He then passed on to consider the different kinds of power, other than manual labour, employed in the haulage of the mineral underground. In the North of England large studs of horses and ponies were kept underground, but this was not considered satisfactory from an economical point of view. This had, consequently, led to the employment of stationery engines underground, and in smaller collieries the endless rope or chain was in use. Connected with this subject was the important one of gradients, on which many experiments had been made by the late Mr. Nicholas Wood, and the conclusion at which he arrived was generally accepted—that from 1 in 130 to 1 in 160 was the most economical for the main roads. In the workings, however, and particularly where they had to follow the coal, a much greater inclination could not always be avoided. A great scope was, however, here opened for the exercise of the ability and contrivance of the mining engineer; as great advantages were gained by a proper apportionment of the powers obtained by an incline in bringing back the empty corves, and of applying a tail rope when the endless rope could not be made available. He concluded by describing some of the dangers attendant upon running trains underground at high velocities, where the strictest discipline was not maintained, and the men and boys prevented from riding upon any of the trucks, or from passing along the roads traversed by the trains. Sometimes, however, the latter could not be avoided, and then a sufficient number of "refuges" should be cut in the walls, at not too great a distance asunder.

DURATION OF OUR COAL FIELDS.

It appears to be now generally acknowledged that the alarm which has been excited with regard to the probable duration of our coal fields would never have existed but for the very imperfect knowledge of the subject generally possessed, and hence it is that especial interest attaches to such papers as that of Mr. E. W. BINNEY, F.R.S., on "The Upper Coal Measures of England and Scotland," read before the Manchester Geological Society.* Mr. Binney remarks that whilst one party asserts that the coal fields will be speedily exhausted, the other estimates that they will continue for thousands of years, and observes that probably the advocates of both these views have not yet adduced sufficient proofs to establish their propositions to the satisfaction of themselves or their readers. The quantity of coal to be obtained will in a great measure depend upon the price that can be paid for it. It may safely be asserted that we do not yet know with certainty where the carboniferous strata end and the Permian begin—in fact, higher carboniferous strata and lower Permian ones may yet be discovered than any with which we are now acquainted. In his paper on the Canobie Coal Field, he some years since gave evidence which showed the occurrence of 200 yards of Upper Coal Measures lying above the Spirorbis limestone, and these appeared to him to be some of the highest carboniferous strata that have been met with in Great Britain, although he could not positively prove their passage into the overlying Permian beds. In the North Staffordshire coal field, Mr. Ward, of Longton, has described a Spirorbis limestone, lying 36 ft. above the Bassey Mine coal and ironstone, and as low down in the coal measures as 1080 ft., according to Prof. Warington Smyth's section. Many years since, the similarity of the North Staffordshire coal field, in its upper portion, to the same part of the Manchester coal field was evident to me, not only from its ironstones and limestone, but also its organic remains. Probably in the present state of our knowledge we shall not be far wrong in assuming the 200 yards of coal measures found lying above the Spirorb's limestone, a little to the north of Canobie Bridge, to be the highest, until higher ones have been discovered, in Scotland, and the North Staffordshire ones the highest in England. This limestone is seen best developed at Ardwick, near Manchester. Since the last published account new beds of limestone continue to be discovered, and more may yet be met with.

Since the time Sir Roderick Murchison published his section of the Ardwick Limestones, in 1839, Mr. Mellor has discovered six superior beds, and 243 ft. 10 in. of coal measures in sinking the new pit previously named, and in all probability there are higher measures still. By the kindness of that gentleman, who drove a tunnel on the dip, Mr. Binney was enabled to see the highest strata given in the section. These beds dipped 20° south of west, at an angle of 18°, and were covered on their dip by a soft red sandstone without pebbles, which dipped in the same direction as the carboniferous strata, but at a less angle, probably about 10°. There was no trace of a passage of one formation into the other, but, on the contrary, there was as sharp and marked a line of boundary betwixt one and the other as in the overlying drift. The coal measures (red and purple shales), both on their upper surface, where covered with drift, and on their dip where covered by red sandstone, had eroded and water-worn surfaces. These were strewn with weathered pieces of Spirorbis limestone, and showed clearly that a denudation of these Upper Coal Measures took place prior to the deposition of the red sandstone, which appears to him to be the lower soft red—the lowest member of the Bunter division—on its eroded surface. What higher carboniferous strata may yet be met with no one can tell, but if all the measures which occur in the North Staffordshire are there, several hundred feet of strata have to be found before there is a chance of seeing the carboniferous strata passing into the overlying Permian strata, in the neighbourhood of Manchester.

The first geologist to point out the value of this upper coal field was Sir R. I. Murchison, in his "Silurian System," and he described the Lebotwood, Pontesbury, Uffington, Westbury, and Tasley, near Broseley beds, and compared and identified them with similar strata at Ardwick. Mr. Howell has carefully described the Spirorbis limestone in the Nuneaton coal field, but he does not say that he found its overlying carboniferous strata passing upwards without a break into the Permian beds. At p. 26 of his Memoir on the Geology of the Warwickshire Coal Field, and the Permian Rocks and Trias of the surrounding district, he says, "In the higher part of the coal measures of this coal field, as already described, there is a thin bed of limestone, which generally occupies a position about 50 ft. below the lowest bed of the Permian rocks. It is generally from 2 to 3 ft. thick, and contains the small serpula Spirorbis Carbonarius, and it is locally known and erroneously called 'fresh water limestone.' It is seldom seen *in situ*, although from the numerous old workings the position of its outcrop is well defined." The same author, at page 30, says:—"The Permian rocks occupy a very considerable tract of country in this district, and are of great thickness, resting directly on the coal measures, and, as a rule, being conformable to them." Their thickness is not less than 2000 ft., and they consist of alternations of pale, red, brown, and purple sandstones, and red marl, with beds of calcareous, breccia, and conglomerate. This limestone has since been found at Prizeley and Gibhouse, near Cleobury Mortimer.

Referring to the Permian and Triassic strata of the North-West of England and the West or Scotland, Mr. Binney remarks that in the vicinity of Manchester the red clays with magnesian limestones, which most probably are the representatives of the lower magnesian limestone of Durham and Yorkshire, vary in thickness from 130 to 300 ft., and contain from four to twelve beds of limestone, and the underlying conglomerate from 1 to 50 ft. At Astley, 54 thin beds of limestone were met with in a bore-hole, and about 30 in a sinking. All these beds contain magnesia in their composition, and are full of fossil shells characteristic of the magnesian limestones of Yorkshire and Durham. At Whitehaven the dips of the sandstones and the coal measures appeared to be about the same: but, so far as his observation went, there was no appearance of the passage of one rock into the other, but only a simple superposition. The lower portions of this sandstone are exactly of the same character as the sandstones of Astley and Bedford, described by me as Lower Permian, and in no wise to be distinguished from a similar coarse sandstone (containing coal plants) seen in the Ballast Quarry, at Moira, near Ashby-de-la-Zouch, which Mr. Woodhouse and other practical geologists of the neighbourhood consider to be quite unconformable to the underlying coal field. It also resembles the Allesley sandstone, found near Coventry, in which the remarkable fossil woods, now in the Warwick Museum, were found. No one can distinguish the silicified woods of Moira from those of Allesley. This rock, if not to be classed as Permian, must be taken as upper and unconformable coal measures; for in Lancashire and Leicestershire it is quite unconformable both to Permian strata above and coal measures underneath. The chief reason which has induced me to remove it from the carboniferous strata is the conglomerate character of the lower part of the sandstone, which, as previously stated, is more like a millstone grit than an upper coal measure rock. It is to be remarked that when the soft sandstone of Collyhurst, Kirkby Stephen, and Hilton is absent this sandstone is generally met with, and so far as Mr. Binney's knowledge extends it has not yet been found at a distance from profitable coal fields; it is absent in all the Permian sections that he has seen in Yorkshire, Westmoreland, and Cumberland, from Westhouse to Penton and Canobie. As previously stated, when the Whitehaven sandstone is present a profitable coal field is generally found near it. Now, in the Permian sections at Westhouse, as well as those of Kirkby Stephen, Belah, Brough, Hilton, and numerous ones about Dumfries and near Moffat, in Scotland, the breccias or conglomerate beds and the lower soft red sandstone are well exposed, but we see no trace of the Whitehaven sandstone under those beds; so, on the whole, that rock appears to be more nearly connected with the carboniferous than the Permian group in these districts away from profitable coal fields. The plants are generally in a fragmentary condition, and present the appearance of having been drifted, so it is possible they may have grown during the carboniferous epoch, and been drifted into the troubled waters in which the sandstone was formed. When, however, we observe it in Lancashire and Leicestershire, it is quite unconformable to the underlying coal measures, and appears to have resulted from the movements of the earth's crust which followed on the elevation of the coal measures, as supposed by Prof. Sedgwick in his paper on the Whitehaven coal fields.

The coal measures of England and Scotland, from south to north, vary very much in their productiveness. In the former there is little or no coal so far down in the series as the millstone grit; while the upper measures, as previously shown in this paper, contain several workable seams of coal near to the Spirorbis limestone, especially to the south of Manchester. In the latter many productive seams of coal are found under the mountain limestone, and above the old red sandstone; but in the Ayrshire coal field, where the Spirorbis limestone has been found, there are 2000 to 2500 ft. of coal measures, in which no coal seam has been met with, although carboniferous plants occur. This variation in the productiveness of the upper coal measures is of the utmost importance in all attempts to sink for coal through overlying Permian or Triassic strata, as will be evident to persons who are even slightly acquainted with the subject. It is quite difficult and expensive enough to sink through the Permian strata in many cases, without having to traverse a great thickness of barren coal measures, containing no seams of coal worth working. Therefore, in all attempts to explore for coal in Permian and Triassic districts the greatest care should be devoted to considering the age, position, and dip of the nearest wrought seams; and where the lower soft sandstone occurs, in many cases, it will be more advisable to follow the coals by inclines on the dip than run the risk of tapping the sandstone, by sinking a shaft through it. While in the eastern coal fields of England, from Ashby-de-la-Zouch, through Derbyshire, Nottinghamshire, Yorkshire, Durham, and Northumberland, and the Scottish fields of the Lothians and Fifeshire, as well as those of West Cumberland, North and South Wales, Clee Hills, the Forest of Dean, Gloucestershire, and Somersetshire, as far as my knowledge extends there has been no evidence yet found of the occurrence of the Spirorbis limestone; so in none of these districts, probably, is the series of coal measures, as at present exposed, so complete as to show the upper coal measures found in the west side of England and Scotland, and other places named in this communication. On comparing the lower and middle coal measures of the west with those in the east, they agree perfectly well. It is only when we come to consider the upper coal measures, containing the Spirorbis limestone, that we find any difficulty, and then we discover from 2500 to 3000 ft. of strata wanting, or not exposed, the Permian and Triassic strata probably covering them up, or their absence may be accounted for by the upper coal measures being unconformable to the middle coal measures.

It has been for years known to geologists and practical colliers that the coals are in no wise deteriorated by passing under the Permian and Triassic formations; and that they exist under those deposits, if they can only be reached. No general rule can be laid down to guide parties in the search for coal under them, except a careful examination of the nature and thickness of the Permian and Triassic beds, and the age and position of the neighbouring coal measures. Of all the difficulties the miner has to dread, the most formidable is the lower new red sandstone, a soft, incoherent sand, that holds water like a sponge, and in the neighbourhood of Manchester sometimes reaching near 600 ft. in thickness. The only favourable feature of this deposit is its uncertain occurrence under the Upper Permian and Trias. At Heaton Mersey, near Stockport, it is probably full 600 ft. in thickness, and at Norbury Mill, some three miles distant to the south, it is not 6 ft. In the midland and southern coal fields, the Permian and Triassic rocks become much attenuated, and in some cases thin out partly or altogether, with the exception of the Keuper marls. This is the case with the Golden Valley coal field, near Bristol, where workable seams of coal have been met with at a moderate depth by sinking through the Keuper marls.

The paper, of which the above is an abstract, is enriched by many useful and interesting sections, and by a well-executed diagram, showing the position of the Spirorbis limestone with regard to the seams of coal and coal measures in various districts. It is undoubtedly one of the most useful contributions to the subject which has been made for some time.

* "Transactions of Manchester Geological Society." No. 3 Session, 1866-7.

LIST OF BLAST-FURNACES IN SOUTH STAFFORDSHIRE AND EAST WORCESTERSHIRE.

(Corrected up to March, 1867.)

Works.	Owners.	Built.	In blast.
WOLVERHAMPTON.			
Chillington	Chillington Iron Co.	4	2
Wolverhampton	Assignees of J. Aston and Co.	2	0
Parkfield	Parkfield Iron Company	5	5
Millfields	Mrs. Gibbons	4	3
Priestfields, Old	W. Ward and Sons	3	0
Priestfields, New	W. Ward and Sons	2	1
Osler Bed	Osler Bed Iron Company	3	1
Stow Heath	W. and J. S. Spanon and Co.	4	2
Willenhall	Fletcher, Solby, and Urwick	3	3
BILSTON.			
Bilston Brook	Bilston Brook Furnace Company	3	2
Herbert's Park	D. Jones	1	1
Barbor's Field	Barbor's Field Iron Company	2	2
Caponfield	J. Bagnall and Sons	3	2
Spring Vale	John Jones	3	2
Deepfields	W. E. Gibbons	3	1
Priorfields	H. B. Whitehouse	3	3
Stonefield	Stonefield Iron Company	1	1
Bradley	G. B. Thorneycroft and Co.	2	0
WEDNESBURY.			
Rough Hay	Addenbrooke, Smith, and Pidcock	3	2
Old Park	Patent Shaft Company	3	3
Broadwaters	S. Groucott and Sons	3	2
Darlaston Green	Darlaston Iron and Steel Company	3	2
TIPTON.			
Wednesbury Oak	P. Williams and Sons	3	2
Willingsworth	J. and H. Haines	3	0
Tipton	Rhos Hall Iron Company	2	0
Tipton Green	W. Roberts and Co.	4	4
Coneygree	Earl of Dudley	3	3
Park Lane	J. Colbourn and Sons	2	1
Horseley	J. Colbourn and Sons	2	2
Stour Valley	J. and S. Onions	2	2
Groveland	G. Hickman	1	1
WEST BROMWICH AND OLDBURY.			
Gold's Hill	J. Bagnall and Sons	3	2
Union	P. Williams and Co.	3	2
Crookhay	W. and G. Firmstone	4	3
Oldbury	W. Bennett	4	0
WALSALL.			
Birchills	John Jones	5	0
Hatherton	W. Eryar	2	1
Bentley	Chillington Iron Company	2	1
Pelsall	B. Bloomer and Son	2	1
Green Lanes	Late Hartland and Co.	2	0
DUDLEY AND EAST WORCESTERSHIRE.			
Corngreaves	New British Iron Company	6	3
Dudley Wood	N. Hingley and Sons	4	2
Withymoor	W. H. Dawes and Sons	2	2
Netherton	J. and G. Onions	2	1
Windmill End	J. and G. Onions	2	2
Windmill End	Hickman and Co.	1	1
The Level	Earl of Dudley	4	2
Netherton New	M. and W. Grazebrok	2	2
Wordside	Cochrane and Co.	3	2
Old Level	Hall, Holcraft, and Pearson	3	0
Shutt End	J. Bradley and Co.	4	3
Oak Farm	Sir S. Glynne	2	0
Corbyn's Hall, New	B. Gibbons	4	2
Corbyn's Hall	W. Matthews	4	2
Russell's Hall	C. E. and J. Bradley	5	1
The Lays	W. and G. Firmstone	3	3
Dixon's Green	W. Haden and Son	1	1
Parkhead	Evers and Martin	2	1
Total		167	95
Furnaces blowing, 1866		114	

BLAST-FURNACES IN SCOTLAND.

(Corrected up to March, 1867.)

Works.	Owners.	Built.	In blast.
GLASGOW.			
Gartsherrie	W. Baird and Co.	16	10
Coltness	Coltness Iron Company	12	8
Summerlee	Wilson and Co.	8	5
Dundyvan	Trustees of John Wilson	3	1
Langloan	Robert Addie	6	4
Govan	W. Dixon	5	1
Calder	W. Dixon	8	6
Carnbroe	Merry and Cunningham	6	3
Shotts	Shotts Iron Company	4	3
Castle Hill	Shotts Iron Company	3	0
Works.	Owners.	Built.	In blast.
Omoa	R. Stewart	4	
Wishaw	Wishaw Iron Company	3	
Monkland	Monkland Iron and Steel Company	9	
Chapelhall			
Clyde	Colin, Dunlop, and Co.	7	
Quarter	Colin, Dunlop, and Co.	2	
EAST COAST.			
Kinniel	G. Wilson and Co.	4	
Almond	J. Russel and Son	3	
Carron	Carron Iron Company	4	
Lochgelly	Lochgelly Iron Company	4	
Gladsmuir	C. and A. Christie	1	
Lumphinans	Lumphinans Iron Company	2	
Forth	Forth Iron Company	7	
Bridgeness		2	
WEST COAST.			
Eglinton	W. Baird and Co.	8	
Blair	W. Baird and Co.	5	
Lugar	W. Baird and Co.	3	
Muirkirk	W. Baird and Co.	3	
Portland	W. Baird and Co.	6	
Dalmellington	Dalmellington Iron Company	7	
Glengarnock	Glengarnock Iron Company	14	
Total		169	
Furnaces blowing, 1866		133	

—*North of England Iron Trade Review.*

THE CANNON KING.

Now that we hear so much about the military greatness and aggrandisement of Prussia, it is natural that we seek to learn the causes of this. They spring from history, still more from geography, the climate, the race of kings, and the nature of the old Brandenburgers and the later Prussians, but which sources we will not now look into.

We have become acquainted with the Needle-Gun, have visited its inventor, Dreyse, and in this we, as well as the world, see at least one principal source of Prussia's newest victories; but here we do not overlook the Cannon King, KRUPP, of Essen, although the eight thousand and some hundreds iron and steel workers of his great Cyclops Foundry work for the world, even for the Japanese. The world-famed work lies in a very favourable position, where the three great railway lines of Western Germany cross each other, two hours from Cologne, in the direction of Berlin. Here, at Essen, Alfred Krupp, at of 14 years, inherited a small workshop for the fabrication of edge tools. genius, courage, skill, energy, and luck he gradually enlarged his little shop, so far that in the year 1865, with the aid of 160 steam-engines, 39 hammers, and 400 smelting, heating, and cement furnaces, he used no less one million tons of cast-steel, of which one-third was made into cannons, the rest into large bars for steam-engines, axles, wheels, boilers, and other work and ornaments.

Krupp's first steel cannons were cast in the year 1849, and were offered chief German powers, but were rejected, as they were unknown and appeared be too expensive articles. Strange to say, the Viceroy of Egypt was the first order these steel cannons. Since then nearly all the great powers of the lised world have bought them, and partly introduced them into their artil Russia resolved first to effect a complete change in her brass and iron cannon steel ones, after Krupp's pattern, which are now made in a separate manu tory, at Alexandroffsky. Prussia gradually admitted Krupp's steel cann which are cast at Essen and rifled at Spandaw, to take the place of her cast- and bronze cannons; but they have a particular system of breech loading, must not be confounded with Krupp's. Belgium and a few small States adopted Krupp's principle, or still use partly the Prussian weapon. The trian and Dutch fleets are partly supplied with Krupp's steel cannon. Italians have also bought some 6-in. breech-loading cannons from Krupp. best customers have been as yet the Turks, who have not bought less than 6-pounders; and the Japanese, when making their interesting journey thro Europe, ordered 60 6-in cannons, of which 30 were delivered last September. to the autumn of 1866 Krupp's works furnished not less than 2500 cast- cannons, principally breech-loaders, of which 400 have a calibre of 8 inches more, and the others from 3 to 4½ in. Krupp's works now cover above 300 use daily 750 tons of coal, work with 120 boilers, are lighted by 7000 flame gas, and employ, as already stated, more than 8000 men and boys, who re yearly 400,000*l.* in wages, besides many other benefits.

In order to retain trained workmen, through their own interests, a sa bank has been founded, to which every workman must contribute from 1d. out of every 3s. of his wages, from which he receives assistance in sick and a good pension in his old age, or unfitness to continue his work through cident. Herr Krupp himself pays to this bank the half of what the work pay. From this source every workman, after 25 years service, receives a cient pension, a blessing and justice of which many other masters have no because with us this is confined to Government service only. People to w any accident may befall receive during the whole time of their inability to their full wages, and other patients are well supplied with food and medi and, lastly, funeral expenses are covered by this bank. Besides this the w enjoy many other privileges. Herr Krupp erected bakehouses for them, b flour in large quantities from Russia, in order that they might always good and cheap bread. Similar arrangements have been made as to food clothing. This fatherly and business-like arrangement is very beneficial the interest of both master and workmen, as is already well known in Eng where the system is more or less adopted in manufactories. The working are divided into two parts—day work from 6 A.M. till 7 P.M., and night from thence till morning.

The iron ore to supply the great demand is brought partly from Krupp mines, in Nassau and near Coblenz, and partly bought. The former supp well-known spiegeleisen. The conversion of iron into steel is effected by the known process of puddling, and smith's iron can be made by the Bess process. Spiegeleisen has much deleterious manganese in it, but of which nearly cleared by the puddling process, so that 98 per cent. is pure iron, and remainder consists of cinder, cobalt, nickel, and a small quantity of phos We have not time now to describe the puddling process, and, therefore, will add that the stirring of melted iron is the hottest and most troublesome job The mass of iron that is to be made into cannons must be softer than other in order to have a certain elasticity, so as to resist the sudden force occa the steely mass. Iron and steel are cut into little bars, 6 in. long, and put smelting-pots, that hold from 30 to 60 lbs. Krupp's smelting-pots were his valuable secret, but those of Kuel, of London, and the Patent Plumbago ble Company, of Battersea, are nearly as good. The foundry is an im building, with furnaces for 1200 smelting-pots at one time, full of the ores. Every furnace has room for 10 smelting-pots, which rest loosely of iron, that can be drawn out. The heat of these furnaces attain such a that the best Scotch fire-proof stones, with which they are built in, and the pots, begin to give way, so that they can be only used once. In ord pour the contents of the various pots simultaneously into a reservoir, and into the mould, the workers are divided quite in military style, and obey the greatest precision the word of command. The directing engineer of the servoir gives the word at the proper moment, which is immediately taken the leader of each section. Some of them now pull the loose bars of iron the furnace, whilst others knock off the hot coals which adhere to the pots "puller" now takes his tongs to lift the pot, and sets it, with the help of on the floor; after which two men carry on a hand-barrow the melted to the nearest trough, and put the tank away, as it is now useless. In this they continue until all the pots are emptied. The molten iron is now to cool, until it is firm enough to be taken off the mould. Then it is surro with hot ashes, and is kept in a red-hot state until it comes to be hammered shape. As this can only be done in cool weather, the largest pieces in times for three or four months in their hot beds, which are always renew keep up the proper temperature.

Nothing appears so picturesque and demoniac as this living and working such fiery masses. Glowing furnaces on every side, out of which numer and invisible workmen draw the large red-hot pots, filled with melted ste the greatest rapidity and seeming ease, to empty them one after the other the trough, until the insatiable-looking form is at last full. As these operat are carried on in a heat of from 20° to 25° Reaumur in the shade out of and the inside of every furnace, and of each of the 1000 smelting retorts, the appearance of a burning sun, one can imagine that Krupp's workmen often to work in a temperature like the three men in the fiery furnace, and therefore, be as fire proof as Shadrack, Meshack, and Abednego; consequ it frequently occurs that some of them faint.

The iron being now more or less in round and square pieces, they are forme their respective shapes, by hammering and turning. Through the regular of the iron, a regular and loose mass is obtained, free of air bubbles, th air blowing. The steam-hammer then gives the red-hot mass the proper ness, and condenses it usually from 2-10ths to 3-10ths per cent. closer, power of resistance rises from 760 to 1320 cwts. on every square inch. mass, for cannons, is pretty soft, and has a resisting power of from 40 to The smaller cannons are made out of a solid piece, those above 8 inches in are joined and fastened with rings. The largest, as yet, manufactured cannon, of 11-in. calibre, is cast cylindrically out of 35½ tons, and 7 ft. meter, and then hammered, after which it is fastened with steel and rings. Two such monsters, each of 540 cwts., and worth nearly 2200*l.* each, been made for the Russian Government. They are breech-loaders, can fire 50 lbs. of powder, a ball of 540 lbs. weight, and are intended for the defe Cronstadt. A still larger monster, of 15-in. calibre, and throwing balls of weight, also intended for Russia, will grace the Paris Exhibition.

The steam-hammers, weighing from 1 to 1000 cwt., play a chief part foundry. The largest one falls 10 ft., and cost 104,000 thalers, of which two were expended in building the bed, and which is so firm, although it has work five years day and night, and shaken the ground all around, that th yet scarcely any sinking to be perceived. One would think that nothing resist the power of these blows, but the large masses of red-hot steel that often to be struck bear the concussion with such stubbonness that they will bend after repeated blows and renewed heating. Therefore Herr Krupp resolved to use a power three times as great to work this steel, and to hammer of 2400 cwts., and with a fall of 13 feet. The cost of this monster mer is calculated at over 200,000 thalers.

Until now steel cannons were Krupp's principal manufacture, but he now produces large quantities of shot and bombs, chiefly for the Russian Govern for whom he has made many thousands of oblong 8 and 9 in. calibre bombs of the finest steel. The smaller kind holds 8 lb. of powder, and is able to a 4½ in. thick plate, without being injured itself; but every one of these cost over 15*l.*, as they are all hammered. Similar ones, but a little smaller made for the Italian Government.

Englishmen also have for years past worked and experimented on a large in this direction, and have produced powerful destructive weapons, as w the shooting now practising at Shoeburyness, at the mouth of the Thame

years they have carried on a kind of competition between bombs and iron ship plates, and have made the former still larger and more destructive, and the latplates, and have made the former still larger and more destructive, and the latter so thick and impenetrable that they have reached a degree of strength which cannot be exceeded, if the ships are to swim at all. But the Whitworth cannons and bombs penetrate at last the thickest and very thickly lined iron plates. Major Palliser's bombs triumphed at last: they are made of cooled iron—that is, they have been dipped into cold water when red-hot. They went immediately through the thickest iron plates and burst uniformly afterwards, which was the case only occasionally with all the bombs formerly tried. A chief point is that they are much cheaper, and require less powder. Now that the thickness and strength of ships' sides cannot be exceeded, and yet cannot resist Palliser's bombs, Englishmen will have a little rest, and may hope that in the next sea battles they will maintain their old superiority. Of course it cannot be foreseen what will take place in Krupp's foundry in the meantime, and in the still more inventive head of the hero of the needle gun in Sommerda. At any rate, England would require sometime yet before she can come up to the one or the other. There appears to be a dissension between the two demigods of military productions—Krupp and Dreyse; as the latter aims at making the work of destruction easier, not only to the infantry but also to the artillery, while the aim of the former is to swell cannons and balls to a terrible greatness. They both work in peace with each other, with unweakened steam and man-power for a still greater perfection and aggrandisement of the most terrible means of destruction of war, and have fired all the colleagues and great powers in the whole civilised world to the most feverish state of activity and production, so that we cannot count upon a lasting peace, but must fear that the next war will eclipse all others in its dreadfulness and great destructiveness. The only comfort we have is that the masters of war and peace, in the knowledge of these terrors, will endeavour more than formerly to sacrifice much for peace, instead of giving the flower of their country's children and the happy work of cultivation to the War God.—Translated from the "Garten-Laube," published at Leipzig.

Edinburgh, March 14, 1867. F. SCHENCK.

GREAT NORTH LAXEY MINING COMPANY (LIMITED).

A general meeting of shareholders was held at the offices of the company, Austinfriars, on March 15,

Mr. CHARLES MARTIN in the chair.

The notice convening the meeting having been read, the report of the directors, which we published last week, was read; and the reports of Capt. Thos. Richards (of Hingston Down Mine) and of the manager (Captain Rowe), having been printed and circulated, were taken as read.

The CHAIRMAN said he would not detain the meeting with any observations upon the occurrences that had recently taken place in the Isle of Man. The directors had in their report stated everything they considered necessary; they naturally felt a little strongly upon the subject, but he had much pleasure in stating that, from the best information the directors could obtain, the management was perfectly satisfactory, and that those gentlemen who thought otherwise had been misinformed, or they would not have acted in the way they had done. He thought they had been avoid all personal feelings, and proceed at once to the business of the meeting. With that view he would propose that the reports and balance-sheet be received and adopted.

Mr. SHERWOOD wished to make a few remarks before that motion was put to the meeting. He did not wish to introduce any personal feelings, for there had already been too much displayed. Mr. Murchison had referred to the Manx shareholders as——

Mr. MURCHISON presumed Mr. Sherwood referred to the directors' report.——Mr. SHERWOOD said, shortly after the correspondence about the managemement in Sept. last in the *Mining Journal*, it was stated "that there was a conspiracy got up to run down the price of the shares." Now, that statement had excited angry feelings on the part of those Manx shareholders who attended the meeting, simply because it was opposed to the truth, as far as they were concerned. An attack had also been made as to the mode in which the Douglas meeting was convened, because the whole of the Isle of Man shareholders were not invited. It was true that Mr. Dumbell was a shareholder, but he appeared to be satisfied with the management, and, therefore, was not likely to join them; Mr. Beckwith was known to be a personal friend of the manager's; and another gentleman, whom they understood was not very friendly towards Mr. Noble, was also avoided. But most of the other shareholders were spoken to with reference to the meeting. A great many charges had been made about false statements. He believed that Mr. Murchison was not able to say that any of their figures as to measurements of work done were wrong, while there was no doubt that Capt. Paul was wrong in his estimates as to quantities, and that he was wrong in his statements as to the shaft, for when his figures showed a depth of 15 fathoms he spoke of the 84 fm. level, which was afterwards called an 82, but now again called an 84. The fact was, the Manx shareholders had taken those figures, and then were accused of making false statements. The fact was they sought the professional advice of Capts. Kitto and Bawden; the former stated he could not see that any other work at all had been done about the mine. He (Mr. Sherwood) believed that Capt. Kitto was not actuated by any personal motives, whilst he was a man well known for his energy and skill; and at the meeting Capt. Bawden went quite as far as Capt. Kitto. Since then the mine had been inspected by Capt. Woolcock (of the Great Mona Mine), and Capt. Trewin, both of whom valued the works at about the same as had Capts. Kitto and Bawden. He (Mr. Sherwood) had no doubt that Mr. Murchison fully believed all he had stated. He (Mr. Sherwood) was quite sure Mr. Murchison believed the Manx shareholders were a bad lot of people, and that they were really trying to get the mine into their own hands; he (Mr. Sherwood) would content himself by simply saying the whole of those statements were not the case. Neither of the gentlemen who attended that meeting were directly or indirectly associated with Mr. Thompson—indeed, some had never seen nor knew him. So far, then, for personal motives; but if anyone had come there to keep up personal feelings he would advise them to follow the advice given in Messrs. Watson and Cuell's "Circular"—"To work the property fairly and honestly together, and not by useless and angry recrimination and dissensions attempt to destroy public confidence in it." (Hear, hear.) (A VOICE: "You began it.") A great deal had been said as to when those shareholders who attended the Manx meeting purchased their shares; but how, he would ask, could that possibly affect the questions at issue? He was perfectly at a loss to conceive what Mr. Murchison really complained of. The Manx shareholders were in this position—they were dissatisfied with the management, they could not go into the matter themselves, they, consequently, obtained professional assistance, and the opinion expressed was—that there was not sufficient work done. There was one matter, however, upon which they admitted they were wrong, which was this—they were mistaken in saying that Mr. Murchison was responsible for the working of the mine. Under these circumstances he (Mr. Sherwood) was fully prepared to admit they had been by far too hard upon Mr. Murchison, and in which they were very wrong. But the Manx shareholders were now present to support neither one side nor the other, and, therefore, he would simply move that the accounts be received and not passed. The directors and their friends, no doubt, would out-vote him, but it would afford an opportunity of putting the motion before the shareholders, who could then say whether they were satisfied or not—that is, the Manx shareholders. He was prepared to give a counter opinion to that expressed. Capt. Richards's report as to the new road and the wheel, and the probable cost of the latter. He did not like to be cavilling at the matter, but there appeared to be some items approved by Capt. Richards which required explanation. Of course Capt. Richards approved of the whole of the outlay, and, of course, the Manx shareholders did not insinuate that Capt. Rowe had put the money into his pocket, although they believed the work done had cost far more than it ought. For instance, there was the item for dressing ore; Capt. Kitto stated that 25s. to 30s., and Capt. Woolcock that 20s. per ton would be ample; but what did they find?—that the dressing cost was 460*l.*, whereas, taking those estimates, it ought not to exceed 300*l.* Another item was for mason's work; Capt. Kitto had been asked about that since, but he was totally unable to guess where there had been any mason's work about the mine.

Capt. ROWE would ask Mr. Sherwood if the wheel-case was not nearly finished?——Mr. SHERWOOD said that was under a different heading. There was no mason's work at all.——Capt. ROWE supposed that Mr. Sherwood imagined that such things as the crushing-house and other such buildings could be erected for nothing.——Mr. SHERWOOD said those and others would be matters of enquiry.

Mr. MURCHISON said Capt. Richards was present, and ready to explain every point.——Mr. SHERWOOD said it could not be gone into now. As to the new road, he was assured that it would cost more for cartage when it was finished than by the old one.——Capt. ROWE would convince the Manx shareholders to the contrary. When finished cartage would not exceed 3s. per ton, in place of 6s. as at present. After referring to the probable cost of the water-wheel, he moved, as an amendment, that the accounts be received, but not passed.

The CHAIRMAN was pleased with the temperate tone in which Mr. Sherwood had addressed the meeting. He need hardly say that shareholders must be grateful to those of their co-shareholders who would take the trouble and interest to investigate the affairs of the mine; but it was to be deplored that so much extraneous matter had to be introduced into the proceedings at the Manx meeting. Had those shareholders been good enough to acquaint the directors with their views, and invited their co-operation for a proper investigation, it would have been readily accorded. But the first intimation the directors had of the matter was the report of the meeting published in a Manx newspaper. At that meeting false statements were made, as well as groundless imputation of motives. One statement was that parties had bought the mine for nothing, and sold it for a very large sum. That was wholly incorrect, but if it were true it was not a proper place to have brought it forward, nor a proper time, inasmuch as the question ostensibly was one of management. The directors would have gladly co-operated with the Manx shareholders in securing an improved management, if it were proved the present one was unsatisfactory. Unfortunately, extraneous matters were incorporated into that meeting, but he (the Chairman) was very glad to find that Mr. Sherwood had disclaimed any personal feelings, and he (the Chairman) hoped such feelings would now be allowed to pass, and the business of the meeting proceeded with. He might mention that Capt. Richards was perfectly prepared to justify his report.

Mr. ADAMS seconded the amendment. He should not have troubled the present meeting with any remarks had it not been for certain statements which were made in the form of a circular issued by Mr. Murchison—whether that circular was sent out upon his own private responsibility, or by order of the directors, he was not aware. If by the order of the directors, he (Mr. Adams) could say nothing against Mr. Murchison; but if Mr. Murchison had circulated those statements, or had caused them to be circulated, at his own suggestion, he (Mr. Adams) was of opinion that Mr. Murchison had travelled very far out of his duties; and if he (Mr. Adams) understood the position of a secretary, his acts were to be regulated by the instructions of the directors.——Mr. MURCHISON was quite willing to take the responsibility upon himself.

Mr. ADAMS would much rather make charges against Mr. Murchison than against the directors. He (Mr. Adams) was present at the meeting in the Isle of Man, and he believed all the persons present at that meeting were persons of respectability, and who were not likely to be led away by improper motives. There were present 16 shareholders, including all in the Isle of Man, with the exception of Mr. Beckwith and Mr. Dumbell.

Mr. MURCHISON said there were upwards of 30 shareholders in the Isle of Man, and Mr. Adams had just informed them that 16 only were present.

Mr. ADAMS said that, at any rate, it was a genuine meeting. One reason why it was convened was because of a general impression among the shareholders in the Isle of Man, and the general public, that the mine was not conducted properly. He found Mr. Murchison, in his letter—and he (Mr. Adams) believed it was sent to many shareholders, besides Mr. Ash, of Manchester, to whom he knew one was addressed—stated that "the principal parties are regretting the course taken at the instigation of parties who misled them, and they offer a public apology, if we agree to two Isle of Man directors, whom we intend to propose." The letter, enclosed by Mr. Murchison, was from Mr. Dumbell, and stated that "the meeting was got up by a few designing and unscrupulous men, from most unworthy motives, with a view solely to gratify personal malice, and have induced some innocent persons to be their dupes." Mr. Murchison said "I enclose you this in confidence;" but he (Mr. Adams) might inform Mr. Murchison, that there could be no confidence where slanders were circulated. If that were Mr. Dumbell's opinion, that the meeting was constituted of persons who might be characterised as "unscrupulous," it was perfectly competent to him to express that opinion privately to Mr. Murchison; but his (Mr. Adams) complaint was, that Mr. Murchison had circulated it among the shareholders, inasmuch as it was a slander. Mr. Dumbell was personally known to him (Mr. Adams)—indeed, he could state that there was no man in the Isle of Man who was a greater personal friend of Mr. Dumbell than himself, and had been so for many years. It had come to his (Mr. Adams's) knowledge that Mr. Dumbell had written a private letter to Mr. Murchison, expressing his opinion about the Manx meeting, and with reference to that he should have said nothing. But he did complain—and complain most bitterly—that Mr. Murchison should be the means of circulating Mr. Dumbell's opinion that a number of persons who attended that meeting, either "designing and unscrupulous men," or partly rogues and partly fools; for if Mr. Dumbell had formed that opinion it was altogether erroneous. The shareholders had but one motive in attending that meeting—they had only purchased into the mine recently, and there was a strong impression in the Isle of Man that the mine was not worked properly, and they were very nearly approaching the end of their capital. All they wanted was to investigate the matter, so as to be able to form their own opinion. He held affidavits in his hand of the persons who attended, which showed that the statement of Mr. Murchison that the principal parties were regretting the course they had taken, and would apologise, was unfounded, and he would further assert that Mr. Murchison knew it to be untrue. (Cries of "Order, order.")——Mr. MURCHISON: Such an assertion is infamous, and I will reply to it.——He (Mr. Adams) would again repeat it, that the statement to the effect that "the principal parties regretted the course taken, and they offered a public apology" was a false statement. It might be said that it was never intended to designate him (Mr. Adams) one of the "principal parties," but his reply to that was that he held the affidavits of nearly everybody present at that meeting, which must embrace the "principal parties," to the effect that Mr. Murchison's statement was simply false, the only exceptions being Capt. Macgregor, Mr. Harris (who being the chief magistrate of Douglas could not administer an oath to himself, but who had given a statement in writing to a similar effect), and Mr. Sherwood, who, he believed, had a special affidavit of his own, owing to something having passed between him and Mr. Murchison. Having read the affidavits, he stated they were made before Capt. Richards made his report, and although he (Mr. Adams) could not, there were other persons, who knew more about the Isle of Man mines, who were competent to give an answer to that report. The affidavits had been made for the purpose of proving there was no truth whatever about improper motives, and that the shareholders were not actuated by improper feelings. It had been stated that they were led away by Mr. Thompson. What was the fact?—why, he (Mr. Adams) did not believe any gentleman, other than Mr. John Cubbon, had any acquaintance of Mr. Thompson whatever. His (Mr. Adams') acquaintancce of Mr. Thompson had been very short. Mr. Thompson happened to be one day dining with Capt. Rowe, who at that time were as thick as—("Order, order," and laughter)—he begged pardon—who at that time happened to be very friendly. He (Mr. Adams) never saw Mr. Thompson before nor since, except at the Great Laxey meeting. He assured the shareholders that those who attended the Manx meeting were actuated with but one feeling, and if after investigation it was found that mere impressions were unfounded, then the result would be a good one. He had made these remarks to show that, so far as he was concerned, and those who attended that meeting were concerned, it was not true they had agreed to withdraw their statements, it was not true they regretted the course they had taken, and it was not true they intended to offer a public apology—to show that those statements were perfectly without foundation. He believed that in Great North Laxey they possessed a very great property, and the only question was as to the best course to adopt in order to make the best use of the capital at command. In order to promote an enquiry, he seconded the amendment.

Mr. SHERWOOD said that no doubt the question about the apology had thus arisen, Captain Rowe in his presence having copied a rough telegram, in which it was stated that "Sherwood will apologise for personalities." That was shown by Captain Rowe to him (Mr. Sherwood); that was the extent of the apology, and the object was to get into correspondence with Mr. Murchison, in order that the matter might be settled, but certainly not of retraction.

The CHAIRMAN said Mr. Adams had addressed the meeting with reference to Mr. Murchison having sent a letter of Mr. Dumbell's to the shareholders; but if anyone had to complain of that it was not Mr. Adams, but Mr. Dumbell. And Mr. Adams should bear in mind that, besides himself, other people have some little sensitiveness. The directors could not possibly object to the shareholders meeting to discuss the question of management, but it was upon the other matters introduced that the strong feelings were created—charges were made which called forth refutations and counter-charges.

Mr. MURCHISON said that Mr. Adams had ventured a piece of advice as to the duties of a secretary. He (Mr. Murchison) would inform Mr. Adams that he was as well acquainted with the duties of secretary as he was; and he would further tell him, that not the least important of those duties was to protect the shareholders, to prevent them being misled and imposed upon by false statements; and that when untruthful assertions were being circulated far and wide, that the secretary was not to wait until a meeting of the directors took place before he took steps to show their utter untruthfulness. It was said of Daniel O'Connell that he once stated that "if you give me 24 hours' run with a good lie, I do not care who you may send after me with the truth." (Hear, hear.) In these cases promptness and energy were essential, and he was not surprised at the extreme soreness displayed by Mr. Adams at the quick way in which his mis-statements had been exposed. Mr. Adams had stated that, with two exceptions, the whole of the Isle of Man shareholders attended that indignation meeting, whereas the fact was that he admitted only 16 out of 37 were present; and, singularly enough, those excluded were those only who could have answered the mis-statements at the time, and thus have prevented much damage being done. (Hear, hear.) The most important statement, or rather charge, that Mr. Adams made was that he (Mr. Murchison) had knowingly stated in a letter that which was untrue. He thought that Mr. Adams ought to have been more guarded, but he (Mr. Murchison) was not now surprised at the reckless statements made at the Manx meeting. In reply to Mr. Adams' charge that he (Mr. Murchison) knew the statement was false that the principal parties at the Douglas meeting were repenting of what they had done, and offered to apologise, he would tell him (Mr. Adams) that it was infamous of him to make such a charge, which was unjustifiable and false, like the other charges made. Now, so far from knowing it to be false, he might inform Mr. Adams that he received a telegraphic message from Capt. Rowe, which was to the following effect:—"If two directors in the Isle of Man are elected, Sherwood will apologise to you for personalities." Whether that was true or not it was not for him to say—the question was—Did that telegram justify him making the statement in the letter. He would now read a letter he had also received, and it was for those present to say whether he was not amply justified in using the statement he did. He would first observe that Mr. R. Sherwood was certainly the principal party at the meeting, for he there made three speeches, and to him had been entrusted the task of collecting all the old reports, &c., and picking all the holes he could in them. The letter which he had received from Captain Rowe stated—"On going to Douglas, yesterday, I found Spittall mediating with Sherwood, and the latter apparently very sorry that he had gone so far, declaring he never intended it, and wished to close up the whole thing. Still he insisted they must have two Manx directors, as his party would never be content without, and this, he thought, might be conceded. He would not insist on any two in particular. He further avowed that he never intended the personal suspicions which had grown out of the affair, and would make a public apology through the papers to you and myself before the meeting, and at the meeting avow how much *they* had been misled, by seeking for and relying on information derived from what he now sees to have been obtained from wrong sources." After that, he would ask whether Mr. Adams was justified in charging him (Mr. Murchison) with having made statements knowing them to be false. When gentlemen in the Isle of Man were so extremely sensitive, it was singular that they themselves should be so ready to make assertions, not only contrary to fact, but detrimental to others. When he (Mr. Murchison) found men making charges at a public meeting—charges not only without the smallest particle of truth, but directly opposed to the truth, he used every means in his power to make their untruthfulness known, and he would do so again. It was stated at that meeting that there had been several companies formed to work the mine, but there was really only one before the present, the original one having been converted from a small private undertaking into a company with limited liability, and then its capital was twice increased by preference shares. With regard to Mr. Dumbell's letter, which appeared to have stuck in the gizzards of those of the Manx shareholders who attended the meeting—

Mr. ADAMS said that the Manx shareholders did not keep their feelings in their gizzards.

Mr. MURCHISON said that they did not seem to have feelings anywhere, for others. In a circular issued by the Manx committee, it was paraded in glowing terms that the "High Bailiff" had presided at their meeting, which it was said was also attended by leading members of the Isle of Man Bar. This was done to influence the shareholders as much as possible by extraneous matters. He (Mr. Murchison) scarcely thought it was a seemly step for a person in the position of the High Bailiff to have taken. The person who should represent impartiality and justice presiding at a meeting where the accused was excluded, and the evidence only on one side was admitted, and then extensively circulated, was scarcely appropriate. Be this as it may, the opinions expressed by Mr. Dumbell in his letter came from a gentleman standing as high as anyone in the island, and as anyone at the Manx meeting—(hear, hear)—not even excepting the "High Bailiff." He (Mr. Murchison) thought there was some little excuse for his sending a copy of his (Mr. Dumbell's) letter to some of the shareholders, to show that all the leading men, and those most able to judge, did not agree with the Manx meeting. He (Mr. Murchison) offered Mr. Dumbell—who was now present—every apology if he had been subjected to any annoyance whatever from him (Mr. Murchison) having in the heat of the discussion circulated a copy of that letter. He (Mr. Murchison) wished it to be distinctly understood that it was not circulated amongst the whole of the shareholders; copies were sent only to a few. He (Mr. Murchison) thought it was, at all events, an excusable justification that the shareholders should be made aware of the fact that there were other shareholders of standing in Douglas who were not parties to the movement. He sent it to others in confidence, and it certainly was never printed. As to the accounts and work done at the mine, those were matters he leave to Capt. Rowe and Capt. Richards to explain. (Hear, hear.)

Mr. DUMBELL said he was sorry that he was compelled to address the meeting upon the present occasion. He had purchased some shares purely as a speculation, thinking well of the mine; he had never in any way whatever interfered with the working nor with the management, although he had always kept himself informed with regard to it; he had studiously avoided ever interfering with Capt. Rowe. He had scarcely ever had one word upon the subject, for he did not choose, as Chairman of the Great Laxey, to interfere with the management of Great North Laxey. He had, however, as he had had already said, kept himself pretty well informed with regard to the working, as he did with all other mines in the island, although, he might say, he held an interest in very few of them. He had been rash enough to act upon the impulse of the moment in writing the letter, and here he had been unfairly mixed up in this affair. He had told Mr. Sherwood and others that he believed Great North Laxey was going on right, and he had now an opportunity of stating more fully his own opinion upon that subject. He had been long acquainted with Mr. Warington Smyth—who, be believed, stood as high, and justly so, as any man in the kingdom with regard to personal character and ability in his profession, and who thoroughly understood his business of investigating on behalf of the Crown the character and extent of the mineral wealth of the country. He knew that Mr. Smyth had recently inspected, among other mines in the Isle of Man, Great North Laxey; and he (Mr. Dumbell) wrote privately to him, as to his opinion of the management. In a very handsome letter Mr. Smyth replied—"I have inspected Great North Laxey; I saw the whole of it, and you know under the former company the mine was 'starved;' they never laid out sufficient to work the mine efficiently, in my opinion; but since the establishment of the present company I am perfectly satisfied that it is judiciously managed and worked—I am perfectly satisfied with the conduct of it in every respect." That, he thought, all would agreed was a very valuable opinion. (Hear, hear.) Now, as to what was pleased to be called an indigna-

tion meeting in the Isle of Man, all he could say that he (Mr. Dumbell) had never heard it was intended to get up a meeting, and gentlemen who complained of him had themselves to blame for the course adopted in that respect. Why was it every shareholder at Douglas was not invited? He had a right to expect a notice as a shareholder, and having some little knowledge of the way in which mines should be conducted, and what object the conveners of that meeting had in not inviting him he did not know, although he could easily surmise the reason—the fact was kept from him, and it must have been studiously kept from him. He would ask was the mode adopted right or justifiable? Was it right that statements made at such a meeting, condemning the management, should be circulated through the length and breadth of the land, and that thousands of extra copies of the newspaper in which the report appeared should be obtained, and sent up to London, and circulated by parties whose object, he was positively informed, could not be to benefit the Great North Laxey shareholders, but with the object of detracting from the character of the manager of Great Laxey. (Hear, hear.) He did feel most indignant at the most unwarrantable course that had been taken. Another undertaking had been damaged by this most infamous procedure, by an attempt having been made to affiliate the whole of the groundless charges upon Great Laxey. A gentleman came into his office, and produced a newspaper—the *Liverpool Albion*—and said, "What on earth has taken place at Great Laxey? Don't you know of this—here's a report of a meeting about the mines, you must be going to destruction." This was the first intimation he had of any meeting, but upon looking at the report he found that the heading had been put "Great Laxey Mine" instead of "Great North Laxey Mine," and as such it was so copied into the provincial newspapers. He immediately wrote to the editor, requiring the fullest possible contradiction, who wrote back to say he had copied the report from the *Mercury*, but made the fullest and amplest apology. He now came to another matter—he had never spoken to Mr. Murchison in his life; he had never had any correspondence with him, nor any connection, directly or indirectly, but he had received a copy of the *Mining Journal*, refuting the statements made at the Manx meeting. He wrote the letter to which Mr. Adams had referred, and he cetainly now complained of the unfair use to which that letter had been applied. It was perfectly true what Mr. Adams had stated, that he and himself (Mr. Dumbell) were good friends—they always had been so, and he hoped they would continue to be so; but at the same time he (Mr. Dumbell) still believed Mr. Adams had been imposed upon, and that he would find it out before long; and, more than that, he believed that the respectability attaching to his person and name had been brought to bear upon this transaction, and that it ought never to have been so. As to the remarks made by Mr. Sherwood with reference to Captain Richards's report, Mr. Sherwood had said that he could not understand the references made by Captain Richards, but he (Mr. Dumbell) could assure the meeting that no man could better understand them. Although he had no doubt there were such documents as the reports of those of Captains Kitto and Bawden presented to the "indignation meeting," yet he had never seen them—that had been observed not only by him but by others. There must have been something in those reports, or they would have been published. Why they were kept back, and why the report of the meeting was circulated without them, he did not know.

Mr. SHERWOOD said the whole of the information given consisted of explanations.——Mr. DUMBELL said, under those circumstances, it was the most extraordinary proceeding he had ever heard of—an inspection of a mine by two mine agents and no report! That, in his opinion, made the whole affair much worse; but, of course, an advocate did not wish to get up evidence against himself. Mr. Sherwood had told them that the mines had been inspected by Capts. Woolcock and Trewin, and whose opinions he set against that of Capt. Richards. He (Mr. Dumbell) had not one word to say about those two agents; he knew them perfectly well, and they were, no doubt, very honest men; but the fact of their being brought forward to reply to Capt. Richards was rather too much for him to stand.

Mr. SHERWOOD: In estimating the work.——Mr. DUMBELL: In estimating the fiddle. (Laughter.) If a man could not report upon a mine he could not estimate the work. In his opinion the amendment had been properly moved for the purpose of making speeches upon it. Surely there could not be any other object. He would advise the shareholders to support the resolution, unless something more was brought forward to the contrary than had yet been done, for there was no prosperity in a mine without union; finding out some lawyers—honest ones he meant—who would throw dirt upon the manager or parties in authority would never succeed. Until he had evidence to the contrary, he should continue to believe the management was honest; he believed they possessed a good mine, but they could never succeed if they continued to squander away the money, with all those reports. (Hear, hear.) He hoped and trusted that they would henceforth work harmoniously together for the general benefit of the company. (Hear, hear.)

Capt. ROWE explained, with reference to the dressing cost, that all the coarse ore passed through the dressing-floors It was the invariable rule to save the stuff and return it, whether it paid or not, and in that way the additional expense was incurred; but, though the dressing of the very coarse ore made the average cost so high, it must be remembered the ore sold when dressed at 13*l.* per ton.

The amendment was put, when 2129 votes were recorded in its favour, and 8013 against it. The amendment was, consequently, declared lost, when the resolution was put, and carried.

Upon the proposition of Mr. WHITE, seconded by Mr. ROBERTS, the following gentlemen were proposed the directors for the ensuing year—W. C. Buller, Charles Martin, William Tuxford, J. Y. Watson, all of London; and James Spittall and William Beckwith, of the Isle of Man. Mr. SHERWOOD proposed that Mr. Harris be elected to one of the seats at the board, instead of Mr. Beckwith, as suggested by the directors in their report.

Mr. ADAMS seconded the proposition. He should be delighted to find that everything was correct, and, therefore, he should like to see a gentleman elected altogether independent of Capt. Rowe. He hoped Capt. Rowe would be able to show all their surmises were unfounded.

Mr. DUMBELL supported Mr. Beckwith.——The election of Messrs. Beckwith and Spittall was put and carried. Mr. Brandt was re-appointed auditor.

Upon the proposition of Mr. E. COOKE, seconded by Mr. PETER WATSON, a vote of confidence was passed to Captain Rowe.——The CHAIRMAN said the feeling of the board was that of entire confidence in Capt. Rowe.

A cordial vote of confidence in Mr. Murchison, and thanks to him for the manner in which he had protected the interests of the shareholders was also passed. A vote of thanks to the Chairman and directors terminated the proceedings.

MINERAL WEALTH OF THE PACIFIC.—Seventeen years since the tide of emigration turned to the Pacific slope, the remembrance of the great excitement attendant on which exodus is still fresh in the minds of our readers. Many of us, too, recollect the fears expressed that the wonderful stories that reached us of the inexhaustible wealth of this then distant land were mere myths, or, at least, that the rich deposits had no source, and would fail as suddenly as they had been discovered, with this difference, that misery instead of *eclat* would ensue. Year after year, however, rolled on, the mines did not give out in the sense predicted, and State after State has sprung up on the Pacific exceeding in wealth, enterprise, and influence any of the equally young States of the Atlantic, while the yield and export of bullion from them is as regular as are those of the grain-producing States of the Mississippi Valley. The silver State of Nevada is being built up with the same substantial rapidity that marked the growth of her golden sister—enters upon her new dignities a crowned queen. In six short years she has climbed, by silver steps, to a prominent position in the eyes of the world. Her mountains of silver yield up their wealth at the touch of the enchanter, the balance of the precious metals is restored, and the coffers of the nations are replenished. The Gould and Curry Mine alone, in Virginia city, of 1200 ft. only, has added over $25,000,000 to the treasure of the world; these mines have proved fabulously rich in silver ores, and the evidence of scientific men is that it is real and lasting. The discoveries made more recently, and the development now going forward, demonstrate that these States, large as they are, constitute comparatively small sections of the great geological belt that fringes the Pacific slope from the Andes to the Columbia River. In addition to the mines in Mantana, Idaho, Arizona, and New Mexico have proved possessed of lodes of gold and silver bearing ore, that dazzle the eye and bewilders the imagination. Labour and capital are all that is necessary to bring billions of bullion annually to light. Individual effort is powerless to the task. Labour must be organised, and backed by substantial capital, in order to ensure success. The prospects of these silver mines were never more brilliant than now; their existence is no longer an experiment, it is a great and recognised fact, challenging the attention of the world. The Pacific Railroad will in a brief time bring her mines to the gates of the sea. When this work is completed every dollar of expenditure is halved, and every dollar of earning is doubled to the silver miner. Shipment of silver from Gold Hill, by Wells, Fargo, and Co., during the month of December:—315 bags of bars of silver bullion, weighing 20,303 lbs., and of the assayed value of $666,984·70—a very handsome yield for one month. Product of Nevada for 1866, $76,000,000.—(*To be continued.*)

IMPROVED INVENTIONS.

"So slow the growth of what is excellent;
So hard t' attain perfection in this nether world."—COWPER.

[TO THE EDITOR OF THE MINING JOURNAL.]

SIR,—It is an extremely silly charge, which is sometimes brought against us as a nation, that the genius of our people shows itself rather in improvement than invention. As if, indeed, it does not require an inventive genius of the highest order, great knowledge of mechanics, and practical skill, all fused together, to bring to full maturity every invention after it has been first made known, that it may be subordinated to the original purpose which the inventor had in view, and thereby become available for the public good. It is important to notice that mechanical inventions are never complete when they are first brought out. It is not given, either, to the same individual to invent and bring to perfection, and even improvements in them are always slow. Anything like completeness at this early stage of its career, however sound an invention may be in principle, is in the far distance, waiting the result of experiments or suffering partial failures. Perfection treads on the heels of invention only after a long-endured and often a very expensive interval,—the Atlantic Telegraph, to wit.

For these reasons any mechanical invention or scientific discovery has in its infancy seldom been universally and without exception well received. Its very novelty is a disadvantage to it. It is often opposed only because it is new. It is deemed an innovation, to be discountenanced at all hazards. Precisely as it is a natural law, so in mechanics, that nothing is begun and perfected at the same time; for have we not "first the blade, then the ear, and afterwards the full corn in the ear." This being the appointed order of things, we ought not to feel any surprise that mechanical expedients share the common fate of all things else. If inventions were brought out in a perfect state, just as our great progenitors stepped into life, a full-grown man and woman, there would be no room for improvement, and none would be required; but such of them as possess real excellence, capacity for improvement, and adaptation to the public service, never hang long on hand waiting for sponsors to father them, under whose cultivation they grow and gradually develope; then, by a series of amendments and discoveries utilised to their fullest extent, they emerge out of infancy into a ripened maturity. Very little more than theory is the character of any invention when first made known.

Even admitting for a moment that our nation is more *au fait* at improvement than invention, still one is readily disposed to question the wisdom of its application, knowing that we can cite the names of inventors whom the whole scientific world has delighted to honour; and who, by directing the force of their original genius to the fuller development of art and cultivation of science, have not as yet been distanced in the race by others elsewhere. Although it is as clear as the sun at noon-day that in such an inventive and progressive age as the present, when so much attention is directed to the study of the experimental sciences, giving so great a momentum to mechanical devices, and producing results so enormous, it is impossible for anyone to determine, scientifically speaking, how long England, or, in fact, any other nation, may be able to hold its own,—Monitor ironclads and needle-guns to wit. A reference to British biography will furnish the names of these sons of science who possessed the inventive faculty in perfection, such as Roger Bacon, the Marquis of Worcester, Sir Isaac Newton, James Watt, Sir Richard Arkwright, and the illustrious originators of our railways, electric telegraphs, cheap postage, free trade, &c. These instances of our foremost men in their respective departments of art or science, but whose long-established reputations we shall not allow to be ignored, are quoted merely to refute an allegation which is somewhat derogatory to our national honour in having given them birth; whose genius has been exercised in scientific research, and producing by their great inventions, and still greater improvements, many things that have increased the comforts and conveniences of life, and greatly heightened its enjoyment.

With these preliminary remarks, I now come to the double intent of this paper—to show that inventions are valuable only as they are capable of adaptation to public use, and that improvements in them may be expected to attain perfection only as they become the objects of public attention and encouragement.

1.—It is a remark of Dr. Johnson's, "that the prosperity of a country is proportionate to the number of hands and minds usefully employed." The writer is pleased to be able to quote so high an authority to the implied value of mechanical inventions, well knowing that amongst the causes to which is attributed our pre-eminent commercial and national greatness the inventive ability of the people is counted as one cause of this greatness. Is it not by the brains of the inventor that the hands of an immense number of operators are set in motion? Do not his talent, his energy, his practical skill, his new discoveries of the utilities of natural substances, with his new thoughts and modes of applying them, all tend to give employment to labour, to multiply and cheapen the necessaries, increase the accommodations, and enhance the pleasures of life? And, looking at this ameliorating process, can it be denied that improved inventions materially assist to make the nation great, happy, and prosperous?

While great inventors are universally allowed to wear the laurels of public benefactors—speaking of them as a body of men thoroughly versed (or, as the modern phrase is, well posted up) in the natural sciences, in which all inventions take their rise—the history of inventions generally is the history of services which have proved blessings to the world, coming home, as Lord Bacon says, "very closely to men's business and bosoms." The question of family pedigree is to some minds an interesting matter of investigation. A man very naturally likes to enquire into the history, the character, and antecedents of his family, and is apt to be proud of him whose prudence and industry laid the foundation of his present wealth. And why not, allow me to ask, of valuable scientific inventions, the period of their introduction, their subsequent improvement, and their practical utility? which, from the moment of their finish and application to the public service became the corner stone of national prosperity, on which numbers have built fame and competency.

John Harrison, an ingenious mechanic, made such essential improvements in chronometers that the Parliament of 1776 awarded him the 20,000*l.* they had offered for the discovery of the longitude at sea; a grant of 3000*l.* was once voted to a person for the discovery of a yellow dye; the sum of 20,000*l.* was publicly awarded to Dr. Jenner, so celebrated for his invention, or introduction, of the system of vaccination; the sum of 70,000*l.* was voluntarily raised by the friends and admirers of the late Mr. Cobden, and presented to him, not as a mere reward, but as an indemnification, because the labour, the correspondence, the time occupied, were all so many sacrifices of the profits of his business, in successfully obtaining for the public the advantages of free trade. In fact, considering that the nation has derived such material benefits from new inventions—improved, reconstructed, it may be, over and over again, very similar to the plan or design of an author, till it reaches the perfect manuscript—it is impossible to calculate, without the financial ingenuity of a Gladstone, the immense value of these benefactions to our nation and contributions to its prosperity. And though last not least, on this part of my subject I would add that inventions possess the power of propagation. The introduction of the telescope by Galileo led Sir James Herschell to the discovery of the Georgium Sidus. The original invention and construction of the first steam-engine of more than two-horse power by the Marquis of Worcester, in the early part of the 17th century, was followed by improvements which rendered it as a machine nearly perfect by James Watt. These improvements, again, in the steam-engine originated steam navigation. If one man invents a new and convenient machine, or a new and profitable mode of manufacture, his efforts so promote the advance, clear the path, and direct the inventive thought, that others, if they possess the gift, will soon be forthcoming who will repeat and multiply his success 30, 60, or 100 fold. With Iago, each might say, "My invention comes from my pate"—the true, original source of all inventions and of all their subsequent improvements. It is in this way, then, that the excellence and value of mechanical and scientific inventions and discoveries are most clearly shown by their adaptation to purposes of public utility.

2. The remaining point is, that improvements will continue to be made in the mechanical arts just as they become the objects of public attention and encouragement. The greater the number of persons of scientific genius and mechanical skill who make it their duty to understand what inventors already exist, as well as what are their defects, the more certainty there is that the world will continue to be enriched by fresh discoveries and improvements in every branch of science. As an intellectual effort this is most obvious, for it cannot be otherwise. The more inventive minds earnestly engaged in achieving improvements there must be more thinkers, more imaginations, more scientific reasoning, and more practical knowledge. In such a league, possessing that power which Providence has conferred only on a few, as no man likes to be inferior, every one will labour, and be morally certain to suggest something new and important. If a happy thought strikes the mind of one it rouses emulation in all; one catches fire from another, and the inventive faculty is completely triumphant. The results to the world are soon seen in fresh accessions to the stock of valuable inventions.

The advice of a great writer to those who study politics is, "first to examine, and understand what has been said by the ancients upon Government, then to cast their eyes round upon the world, and consider by what causes the prosperty of communities is visibly influenced, and why some were better and others worse administered."

Now, this is the exactly prescribed formula of mechanical science, which in the present age has received such astonishing advances and illustrations. Its professors thoroughly acquaint themselves both with the inventions which the ingenuity of former periods has already achieved, and also with their imperfections; then, by facility of expedients, readiness of thought, extensive mechanical knowledge, and clear, enlarged appreciation of the principles of their construction with the original purpose the inventor had in view, add such improvements as are suggested by their experience and observation. And so patent is the magic of science, when applied to the arts of life, that every practical advance developes some new principle, or lends additional confirmation to the value of some modern appliance. The total result being not success merely in this present age, but favourable to the perpetuity of mechanical and scientific improvements through all ages to come.

"Inventions were not of an age, but for all time."

So simple appears even the greatest of our modern inventions now it has been accomplished, that for a moment it makes us wonder our sharp-witted ancestors, with the same natural productions about them, and the same minds and hands to manufacture, with the same wants, and possessing the same abilities to supply them, could have suffered their age to pass away without inventing what we have in our own. Ignorance of so much that nearly concerned them is accounted for, perhaps, by the fact that there were no national associations then for the advancement of the arts and sciences, or, at least, they did not receive an equal degree of public attention and encouragement.

A period in our country's history that was marked by the profession and pursuit of foreign wars was not eminently favourable to the development of the human intellect, nor for the production of inventions and discoveries in the useful, peaceful arts of life.

"Those barb'rous ages past, succeeded next
The birth day of invention."

Our age, on the other hand, has been an era of comparative peace, progressive improvement, and gradually increasing national prosperity. The advance of the arts, and of discovery especially, has been accelerated by such a fortunate change of circumstances. Prosperity has a natural tendency to give the mind a spring, which is vigorously exerted in every new pursuit. Improvements, therefore, which are the true causes of our national greatness, have been steadily going on in religion, in legislation, in general literature, and in the sciences. They have not once stopped, nor even slackened speed; and, judging of the future by the past, we may indulge the hope that improved inventions will continue to produce results more important than have hitherto been witnessed as contributions to the material prosperity of the nation. In an ode to Science, an old poet has thus expressed himself— "Of wealth, power, freedom, thou! the cause;
Foundress of order, cities, laws,
Of arts inventress, thou!
Without thee what were human kind?
How vast their wants, their thoughts how blind!
Their joys how mean! how few!"

72, *Packington-street, N.* ROBERT BULGIN.

MINING SURVEYORS' FIELD-BOOK.—The second edition of Mr. DAVIS HASKOLL'S "Engineer's, Mining Surveyor's, and Contractor's Field-Book," has just been issued through Messrs. Lockwood and Co., of Stationers'-Hall-court, and contains a far larger amount of information as to the application of the tables; thus he has given an explanation of the system of levelling with the theodolite, by which the student may perceive how rapidly a network of trial levels may be obtained over a very extensive area through a hilly country, and also of the system of traverse surveying and plotting. Tables are also given for setting out curves by numerous offsets from one tangent. There has also been added earthwork tables for every 6 in. up to 80 ft. deep, and a table of gradients, which will be found to reduce very considerably the labour of preparing working sections. The book contains all that the practical man is likely to require, whilst the fact of its being admirably printed from most legible type greatly enhances its value.

PORTRAITS OF POPULAR PERSONAGES.—Messrs. Schenck and Son, of Edinburgh, to whose admirable portrait of Mr. Robert Crawshay, of Cyfarthfa Castle, reference was made in the *Mining Journal* of March 9, have just been entrusted with the execution in lithography of the portrait of the Countess of Fife, after the large oil painting by Sir Francis Grant, P.R.A.; it is a presentation picture got up by the tenantry of the Fife estates, and represents the countess standing at an open window, with a Scotch terrier at her side—the terrier being painted by Sir Edwin Landseer. To judge from the excellence of Mr. Crawshay's portrait, both as a work of art as well as from the striking character of the likeness, it may be anticipated that that of the Countess of Fife, who is highly popular, will be very favourably received, from the opportunity it will afford of obtaining an excellent picture at a small price.

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